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An Enhanced Emergent Model of Knowledge Management Processes

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Abstract

Background*: Knowledge management (KM) is the process of employing systematic procedures to gather, create, manage, and distribute knowledge inside an organization. Manufacturing industries are faced with numerous challenges such as absence of skilled personnel, supply chain issues, digitization and automation challenges which can slow down the growth of the industries who are willing to improve performance. There is a need for manufacturing firms to integrate AI into their business while considering the mediating role of knowledge management processes to improve manufacturing firm performance. There is paucity of mediating factors necessary to bring about performance in manufacturing industries. These factors are necessary and relevant in enhancing the effect of AI in manufacturing industries that help managers and employees make quick and accurate decision, store knowledge for future use, improve creativity and help in innovation that bring about overall industry performance, hence, the study bridges this gap.*. **Aim:** *The aim of this study is* to *design an enhanced Emergent model of knowledge management processes using AI in manufacturing industries, by identifying relevant factors that can mediate between AI and Manufacturing Industries. Building on the knowledge base view theory, in the business domain, particularly manufacturing industries. This study covers five relevant mediating factors including knowledge management processes, communication and collaboration, information technology infrastructure, Risk management practices, Leadership and organizational alignment in manufacturing industries.* ***Method****: the study enhanced an emergent model of knowledge management process by addition of more mediating factors, through the review of relevant literatures, a total of five factors necessary for an overall manufacturing firm performance were identified* **Result:** *The addition of the aforementioned factors resulted in an enhanced emergent model that aids in manufacturing industry performance.*

Keywords: *Manufacturing firm Performance, Supply chain Resilience, Artificial Intelligence, Knowledge Management, Communication and Collaboration*

1. Introduction

The term knowledge management (KM) is the process of employing methodical procedures to gather, create, manage, and distribute knowledge inside an organization in order to improve performance through the adoption of best practices, quicker work, and lower rework costs (Abubakar et al. 2019).
Iqbal et al. (2019), further defined knowledge management (KM) as the planned, coordinated use of knowledge practices with the assistance of strategic enablers.

Knowledge management emerged as a scientific discipline in the early 1990s, thanks to the efforts of individual practitioners like Skandia, who appointed Leif Edvinsson of Sweden as the first chief knowledge officer (CKO) in history. A CKO's role is to manage and minimize a firm's intangible resources (Claire, 2002). The main goal of knowledge management (KM) is to facilitate collaboration, sharing, creation, and application of information across individuals and organizations in order to improve performance, foster innovation, and expand both groups' knowledge bases (Rhem, 2020). Industries need knowledge management because it helps them manage their information effectively and efficiently, which can be valuable to the business and improve manufacturing industries' overall performance (Sutopoh et al., 2017).

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Knowledge management process requires effective knowledge management process execution, precise and objective capture of knowledge as well as the facilitation of knowledge distribution across the entire company. This process is often referred to as knowledge mapping. People within the organization who would need this knowledge to carry out their jobs are guaranteed to have access to it thanks to the mapping procedure (Imhanzenobe et al., 2021).

Knowledge acquisition, conversion, and application are the three (3) primary acknowledged knowledge management processes according to (Alavi et al., 2005; Gasik 2011; Gold et al., 2001). While knowledge conversion refers to making the knowledge gained useful to the organization (Gold et al., 2001) by compiling it or converting tacit knowledge into explicit knowledge, knowledge application refers to using the knowledge to carry out tasks (Sabherwal & Sabherwal, 2005), which in turn affects firm performance (Ferraris et al., 2019). Knowledge acquisition is the process used to develop new knowledge from data and information.

Artificial intelligence (AI), has been heralded by scholars as the next source of business value. It is described as computers' ability to perform cognitive functions, such as perceiving, reasoning, and learning and problem-solving, that are usually associated with human minds Bawack et al. (2021).

Li & Wang (2020), also defined AI as the use of computers to imitate the human brain's reasoning, learning, planning, and other thinking activities, thus solving complex problems that only human experts could previously tackle The application of AI, in particular, makes it possible for machines to carry out tasks and reveal or unlock knowledge that can be given to people to enhance the industry's decision-making processes (Camarillo et al., 2018; Grzonka et al., 2018; Vajpayee & Ramachandram, 2019). According to Paschen et al. (2020), artificial intelligence (AI) has the ability to extract new information from enormous amounts of data, which forms the basis for human decision-making. AI also offers tools for both creating and expanding new knowledge.

Manufacturing industries are faced with numerous challenges such as lack of skilled personnel, supply chain issues, digitization and automation challenges. According to which can slow down the growth of the industries who are willing to improve performance, to achieve this, there is a need for manufacturing firms to integrate AI into their business while considering the mediating role of knowledge management processes to improve manufacturing firm performance (Leoni et al., 2022).

According to Zheng et al. (2021), it is ineffective to merely deploy AI techniques without implementing suitable knowledge management procedures. The discovery of relevant factors by managers and staff that mediate the successful use of AI and manufacturing industries required for an overall performance is one of the main drivers of enhancing performance in manufacturing industries.

In our study, we enhanced a conceptual model of knowledge management processes by the addition of factors that mediate AI and manufacturing industries, to create a more powerful and robust model to improve the performance of manufacturing industries.

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2. Related Works

2.1. **Knowledge Base View Theory.**

Knowledge based view of the firm is a concept from the field of strategic management and organizational theory. It emphasizes the importance of knowledge within an organization.

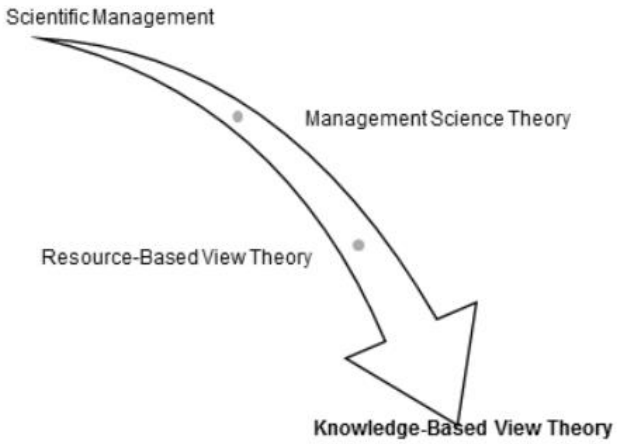

Figure 2.1.Theoretical development of the Knowledge management theory (**Source**: Adopted from Imhanzenobe, et al.(2021)).

The Knowledge Based theory of the firm (also referred to as *Knowledge Based View Theory*), proposed by Professor Robert Grant, is a commonly recognized framework that explains the function of knowledge in accomplishing organizational objectives, frequently centered around gaining and maintaining a competitive advantage (Grant, 1996). The Resource-Based View Theory gave rise to the Knowledge-Based View Theory. This spin-off was based on the recognition of knowledge as a key unique and inimitable resource that helps an organization to stand out among its competitors (Grant, 1996; Hoskisson et al., 1999).

In recent times, productivity has depended on the ability of employees and managers to create new knowledge, learn, adapt, and generate "smart" action (Tzortzaki & Mihiotis, 2014). Intellectual capital is the term used to describe this new knowledge, which is thought to belong only to the company that created it. Numerous studies have indicated that this intellectual capital is essential to any company's overall success (Clarke et al., 2011; Wang et al., 2014; Inkinen, 2015). Therefore, in order to facilitate the acquisition and administration of intellectual capital, businesses should work to establish knowledge management systems.

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2.2. Conceptual Research Model

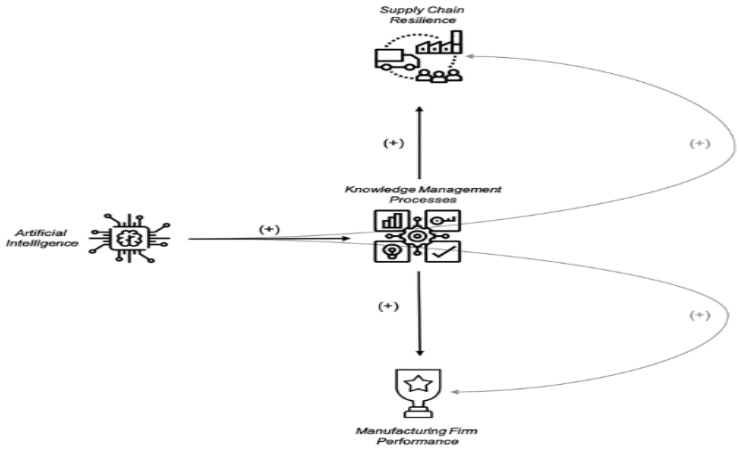

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Figure 2.2: Emergent Conceptual Research model (**Source**: Adopted from Leoni et al. (2022)).

Grounded on the knowledge base view theory of the firm, Leoni et al., (2022), put forward a conceptual research model that seeks to provide and empirically test a conceptual model in which artificial intelligence (AI), knowledge management processes (KMPs) and supply chain resilience (SCR) are simultaneously taken into account with regard to their mutual connections and influence on the performance of manufacturing firms (MFP). They verified the conceptual model using an empirical survey and demonstrated the benefits of AI adoption for KMPs as well as the impact of KMPs on SCR and MFP. Additionally, show how KMPs act as a mediator through which AI affects SCR and MFP.

2.1.1 Factors of conceptual Research Model

The conceptual research model by Leoni et al.(2022) is a model of the knowledge base theory. The model has a total of three (3) factors, included as: Artificial Intelligence, Knowledge Management Processes, Supply Chain Resilience and Manufacturing Firm Performance. Based on the diagram in figure 2.2. The factors are classified into three, namely, the external, instantaneous and temporal factors, shown in table 2.1

Table 2.1: Factors of Conceptual Research Model

External	Instantaneous	Temporal
1. AI	1. Knowledge management processes	1. Supply chain Resilience 2. Manufacturing Firm Performance

The review of the factors in the conceptual research model is necessary because they form the bases for the development of our conceptual model in the present study

Artificial Intelligence (AI)

Artificial Intelligence (AI) is the process of employing computers to mimic the learning, reasoning, planning, and other cognitive functions of humans in order to solve complex issues that were previously only able to be solved

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by human experts (Lei and Wang, 2020). AI, in particular, gives machines the ability to learn, gather, process, and apply knowledge to carry out tasks; this uncovers or unlocks knowledge that can be transferred to humans to enhance organizational decision-making processes (Camarillo et al., 2018; Grzonka et al., 2018; Vajpayee and Ramachandran, 2019). While Ciampi and Rialti (2019) noted that AI adoption in knowledge-intensive manufacturing firms may increase firms' performance, Modgil et al. (2021) and Yu et al. (2019) have shown how the adoption of AI for SCR ensured business continuity and improved firm performance before and during COVID-19.

Borges (2021) employed the systematic literature review approach and a research piece to examine the ways in which AI technologies have attracted attention from academic literature and business organizations over the past ten years. Addressing issues related to artificial intelligence use is the study's goal. Decision support, employee and customer interaction, automation, and new products and services are the four sources of value creation identified by the research's conclusions. Further research by Wirt, Weyerer, & Geyer (2018) revealed that developments in AI have drawn a lot of interest from academics and industry professionals and have created a wide range of advantageous opportunities. This research was done to understand the variety of impact of AI-based applications and related challenges.

According to Mittal & Kumar (2019), AI can push knowledge management making KMPs more effective. Furthermore, AI can increase a company's efficiency by automating data management procedures and doing away with the need for middlemen, as Butler et al. (2021) pointed out in their comprehensive literature analysis. Therefore, artificial intelligence (AI) has the potential to improve network communication, which will support innovation within a business.

Knowledge Management Processes

Grant (1996) proposed the knowledge-based view (KBV) of the firm, which holds that knowledge is a firm's most valuable resource and the only long-lasting source of competitive advantage that can enhance a firm's ability to make decisions and, as a result, its ability to take successful action. Paniccia, (2018). KM "is the process of creating value from an organization's intangible assets" (Liebowitz, 2004, p. 1). The identification of KMPs essential to the creation and application of the knowledge required to generate competitive advantage has received more attention.

According to Alavi and Leidner (2001), knowledge management procedures consist of five primary, independent but interrelated operations: (1) acquiring, (2) creating, (3) using/applying, (4) archiving/storing and updating, and (5) sharing/transferring. According to KM studies, companies must appropriately implement these KMPs in order to enhance organizational performance. Hussinki et al., (2017).

Tan & Wong (2015) state that manufacturing companies are beginning to understand the value of KM and adopting KMPs because they are able to positively impact their performance, delivering "many advantages like obtaining up-to-date production information, quickly resolving production issues, and enhancing the quality of products and processes.

Supply Chain Resilience

Umar et al. (2021) asserts that the supply chain's capacity to effectively gather, disseminate, and apply knowledge is essential to ensuring that the network can anticipate and react to calamities, hence reducing its susceptibility. According to Ali et al. (2021), Anbanandam (2019), KMPs strive to attain and improve Supply Chain Resilience (SCR), numerous research (El Baz &Ruel, 2021; Nikookar & Yanadori, 2021; Ozdemir et al., 2022; Shen & Sun, 2021) have already shown that SCR is an essential capability in times of crisis. According to Hosseini et al. (2019), SCR actually relates to the capacity to regain performance following disruption effects.

According to Li et al. (2017), implementing SCR can lead to positive financial results by enabling a firm to respond to competitive disruptions more rapidly and efficiently. This can increase a firm's market share, goodwill, and profitability. Thus, by guaranteeing steady service and stock availability and enhancing the capacity

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to handle diverse disruption risks, SCR can directly affect the profitability of businesses (Altay et al., 2018; Liu & Lee, 2018).

Manufacturing Firm Performance

Numerous factors have been found to have a major impact on an organization's success based on research on the financial and operational aspects of organization performance. Factors including intellectual capital, enterprise risk management, and stakeholder participation, among others (Al-Tit & Qassim, 2017).

Organizational performance is highly predicted by supply chain management techniques and organizational culture, according to research by Al-Tit & Qassim (2017). The study conducted by Ayinaddis (2023) demonstrated a positive and significant correlation between business success and the following factors: product, process, marketing, and organizational innovation. The study conducted by Ekadjaja, Wijaya, & Vernetta (2021) yielded no significant results regarding the relationship between firm age and liquidity. On the other hand, the study revealed a positive correlation between firm size and growth and a negative correlation between leverage and firm performance. This research implies that excellent management is necessary to boost company performance.

3. Methodology

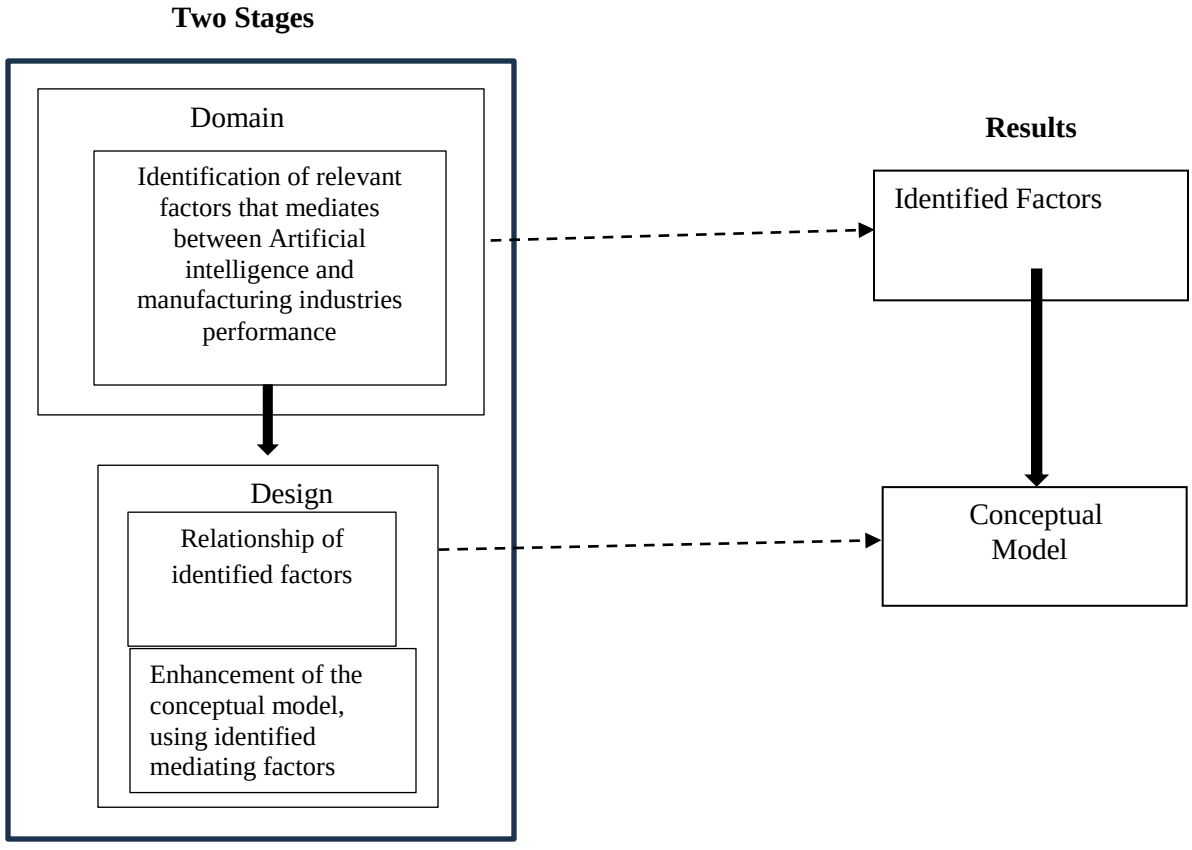

Figure 3.1. Research Methodology *source: (*Adapted from Mustapha 2019; Mustapha et al. (2020)).

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This methodology has been used in agent-based modeling research for various domains, such as driving (Mustapha 2019, Mustapha et al; 2020), Energy consumption (Rai & Robinson 2015) among others.

3.1 Domain Model Stage

In this stage, relevant mediating factors that brings about manufacturing firm performance are identified. The stated model has eight (8) factors as against the four factors identified by Leoni et al. (2022). The eight (8) factors identified were categorized into three namely: External, Instantaneous and Temporal factors. The causal relationship of the identified factors of the conceptual model were based on the knowledge base view (KBV) theory of the firm.

For the identification of these factors, the internet and library resource were used to review relevant literatures from experts in various domains, especially in the domain of knowledge management and Artificial intelligence. The step taken to obtain the model stage. The result of this stage is the identification of relevant mediating factors f or the enhancement of the conceptual model. The result from this stage fulfils the first research objective.

Design model stage

In the design model stage, five (5) mediating factors such as communication and collaboration, information technology infrastructure, Risk management practices, supplier and customer relationships, leadership and organizational alignment were obtained from other related literatures, combined to enhance the conceptual model, of Leoni et al (2022).

Each of the factors in the model is represented by a node, and the casual relationships between the factors are shown using flow arrows. To create an enhanced emergent model of knowledge management processes. Relevant mediating factors of AI and manufacturing industry performance were identified, the direct and indirect relationships were taken into account based on the theories of each concept.

The process used by Mustapha (2019), the design model represents the relationship between factors identified from the domain model stage. For example, to demonstrate the stage, F, G, H, I and J are factors identified from the domain model stage, then the design model can be presented in figure 3.2. if F, G, H, I and J are factors identified from the domain model stage, the relationship between these five factors (F, G, H, I and J is shown using a set of flow arrows as shown in figure 3.2 obtained based on theories where the factors are identified.

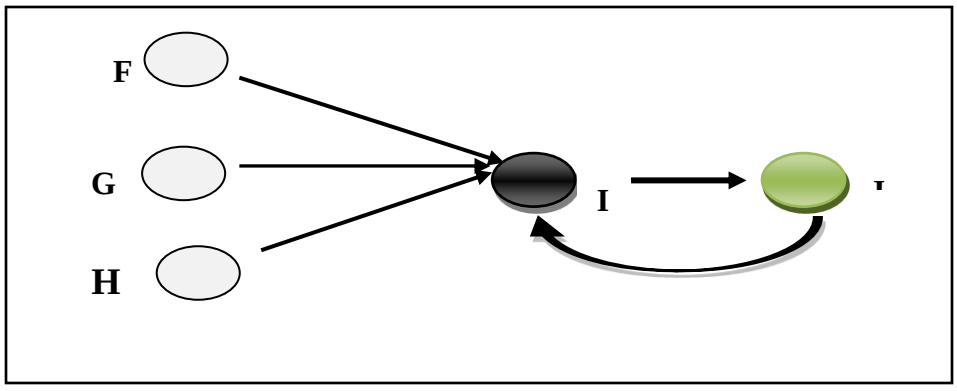

Figure 3.2. Example of Design Model

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From figure 3.4, F, G, H are input (external) factors, I is an instantaneous factor while J the temporal factor, determined by the combination of the input and instantaneous factor.

4. Result and Discussions

This section discusses the Enhanced Conceptual Research Model Factors and the Proposed Enhanced Mediating Model Factors as in subsections 4.1.

4.1 Enhanced Conceptual Research Model Factors

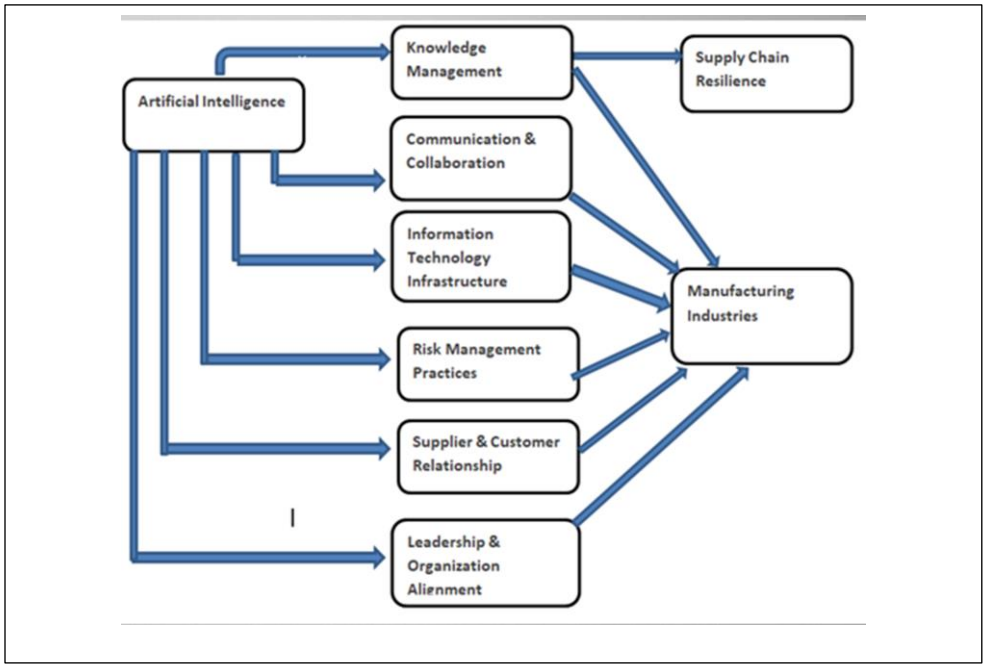

Figure 4.1: An Enhanced Emergent model of Knowledge Management Processes

In enhancing the conceptual model, mediating factors relevant for manufacturing industries performance were identified based on theories of the knowledge-based view and scholarly literatures. The factors identified include Communication and Collaboration, Information Technology Infrastructure, Risk Management Practices, Leadership and Organizational alignment, and Supplier and Customer Relationships
Hence, details on how the factors were identified in our present study and the casual relationship based on literatures are as follows.

Communication and Collaboration
Collaboration refers to more than two parties working together in the pursuit of completing tasks and eventually achieving joint goals (Liao et al, 2017). Better industry performance and total cost reduction are the outcomes of efficient key information exchange (Chen et al., 2017). Effective communication and collaboration among different departments and teams within the manufacturing industry can mediate the impact of knowledge management. Developing new products through collaboration is seen as beneficial to suppliers as well as customers, businesses are faced with the issue of how to build and develop long lasting collaborative relationship for innovation success (Hardwick, Jilian & Alistar, 2019).

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According to research by Rashid et al. (2023), technology enhances supply chain collaboration, which in turn improves organizational performance. People's involvement in the process also has a good effect on supply chain collaboration. Successful collaboration is predicted to not only strengthen a buying firm performance but also reduce transaction costs Um & Kim (2019).

Information Technology Infrastructure

Infrastructure expenditures are required at multiple levels for AI technology, according to Chui & Malhotra (2018), and this poses a big challenge for many enterprises. Depending on the application, the source material, the stage of development and use, and other factors, there are wide variations in the amount of data required for AI applications. Businesses must therefore make investments in storage systems that are scalable in response to demand, able to manage volume and a variety of formats. (Bayless et al, 2020).

According to Pavlova (2017), IT personnel have the ability to create a link between IT and business plans by assigning the right resources to enhance a business process more successfully and economically. IT infrastructure is dependent on both IT personnel and management decisions.

Risk Management Practices

Risk management is the practice of skillfully controlling risks, particularly those that could create opportunities or pose a threat to construction projects' objectives (Hakkarainen, Kasanen, & Puttonen, 2020). Risk awareness and control have a significant impact on how well manufacturing organizations function, and risk management approaches significantly enhance the performance of manufacturing organizations (Johncally & Toyin, 2023). To ensure an improvement in the performance of the manufacturing sector, management of manufacturing companies should ensure that effective risk management methods, such as early risk identification, risk assessment, and an efficient system for controlling and reducing risks, are in place. Risk is the possibility that future investment returns will fluctuate, according to Siringi & Obange (2022). An in-depth analysis of the core concepts of risk minimization, opportunity maximization, and uncertainty readiness is required for efficient risk management Mu (2021).

According to Fountaine et al. (2019), companies need to shift from a risk-averse strategic approach to one that is flexible, exploratory, and adaptable. They also emphasize that a mentality shift or change in attitude is required in order for businesses to gain from AI. Also, Ransbotham et al. (2018), noted that risk-takers see artificial intelligence (AI) as a business opportunity that they need to grab before competitors do, since AI is one of the most competitive, exciting, and value-added areas of business going forward

Leadership and Organizational Alignment

Ciulla (2020), defines leadership as the ability to persuade others to take action. This approves the important position and power of leadership in controlling the business actions with the aim of improving organizational climate.

Therefore, in order to directly and indirectly improve an organization's performance, each firm must increase the efficiency of its organizational leadership (Arzubiaga et al., 2018; Moslehpour et al., 2019).

According to scholars (Feng et al., 2019; Saha et al., 2019; Sarwar et al., 2020; Shafique et al., 2019), a company's efficacy, performance, and success are intimately linked to the leaders' ethical attitude and approach over a particular organization. Effective leadership and organizational alignment with knowledge management goals can mediate the success of knowledge manage initiatives.

Supplier and Customer Relationships

One of the main concerns of relationship marketing is developing trust in buyer-seller relationships. (Paparoidas, Katsikeas & Chupitaz, 2017) In the corporate world, building enduring trust-based relationships between suppliers and customers has long been a practice, mostly because it has been linked to substantial advantages for both sides (Skarmeas, Zeriti, & Baltas 2016). Successful collaboration and sustainable performance have been found to be critically dependent on suppliers and buyers' continuous relationship learning and information

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technology integration (Connor, Lawry, & Treiblmaier, 2020). In a study by Munir, et al. (2020), result indicates that while supplier and customer integration partially mediate the influence of internal integration, supply chain risk management is positively impacted by internal, supplier, and customer integration.
The quality of relationships with suppliers and customers can be an important mediator which can bring about more resilient supply chain and improved industry performance.

4.2 Proposed Enhanced Mediating Model Factors

Table 2.2: Proposed Enhanced Mediating Model Factors

Emergent Conceptual Research Model (Leoni et al., 2022)	Proposed Enhanced mediating Model factors
Artificial Intelligence Knowledge Management Processes Supply chain Resilience Manufacturing Firm Performance	• Communication and collaboration • Information technology infrastructure • Risk Management Practice • Leadership and organizational Alignment • Supplier and Customer Relationships

Table 2.2 shows the emergent conceptual model factors and the proposed enhanced mediating model factors.
The present study proposed and enhanced conceptual model of knowledge management processes by the identification of more factors. Achieved by addition of more factors obtained from other literature.
A total of five (5) factors such as Communication and collaboration, Information technology infrastructure, Risk Management Practice, Leadership and organizational Alignment, Supplier and Customer Relationships are realized in order to have a comprehensive conceptual model, that has eighteen (8) relevant factors to aid mangers in manufacturing industries in making strategic decisions relevant for overall organization performance.

5.0. Conclusion

Building on the knowledge based view theory of the firm, the study presented an Enhanced Emergent model of Knowledge Management Processes that contributes to an improved performance of manufacturing industries. The study enhanced an emergent model of knowledge management process by addition of more factors that resulted in a robust model. Five (5) factors were added, based on the KBV theory of the firm and other related literatures, reviewed and used as a guide in obtaining these factors. The five factors included as: *knowledge management processes, communication and collaboration, information technology infrastructure, Risk management practices, Leadership and organizational alignment* was combined using flow arrows to show the relationship of one factor to the other which resulted in an enhanced emergent model of knowledge management processes, as these factors contribute to performance of manufacturing industries.

The interplay of the aforementioned relevant mediating factors between AI and Manufacturing industries performance significantly influence and enhances performance in manufacturing industries, these factors serve as crucial channel for leveraging AI technologies effectively, thereby fostering innovation.

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